

# NEOSHO RIVER BASIN TOTAL MAXIMUM DAILY LOAD

**Water Body: Fox Creek Watershed including Palmer Creek**  
**Water Quality Impairment: Biology**

## 1. INTRODUCTION AND PROBLEM IDENTIFICATION

<b>Subbasin:</b>	Lower Cottonwood
<b>Counties:</b>	Chase and Morris
<b>HUC 8:</b>	11070203
<b>HUC 11 (HUC 14):</b>	<b>020</b> (040) (Figure 1)
<b>Ecoregion:</b>	Flint Hills (28)
<b>Drainage Area:</b>	36 square miles
<b>Authority:</b>	United States Department of the Interior, National Park Service
<b>Main Stem Segment:</b>	WQLS: Fox Creek (19); starting at biological monitoring station 718 (Fox Creek North of Strong City), traveling upstream, and ending near the southern border of Morris County.
<b>Tributary:</b>	Palmer Creek (403)
<b>Designated Uses:</b>	Expected Aquatic Life Support, Secondary Contact Recreation; Food Procurement; Livestock Watering Use
<b>2002 303(d) Listing:</b>	Neosho River Basin Streams
<b>Impaired Use:</b>	Expected Aquatic Life Support on Main Stem Segments.
<b>Water Quality Standard:</b>	General--Narrative: Surface water shall be free, at all times, from the harmful effects of substances that originate from artificial sources of pollution and that produce any public hazard, nuisance condition or impairment of a designated use. (KAR 28-16-28e(b)(1)).

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Stream Monitoring Site:** Station 718 North of Strong City (Fox Creek)

Period of Record Used: 1998 - 2001 (Stream Biology)

Period of Record Used: 1998 - 2003 (Stream Chemistry)

Level of Support for Designated Use: Category 5, Priority 1: Non-Support due to Mussel Loss

**Stream Monitoring Site:** Station 719 North of Strong City (Palmer Creek)

Period of Record Used: 1998 - 2001 (Stream Biology)

Period of Record Used: 1998 - 2003 (Stream Chemistry)

Level of Support for Designated Use: Category 2: Uncertainty if there is a true impairment

**Flow Record:** Matched to flow duration for Cedar Creek near Cedar Point (07180500)

### Fox Creek TMDL Reference Map

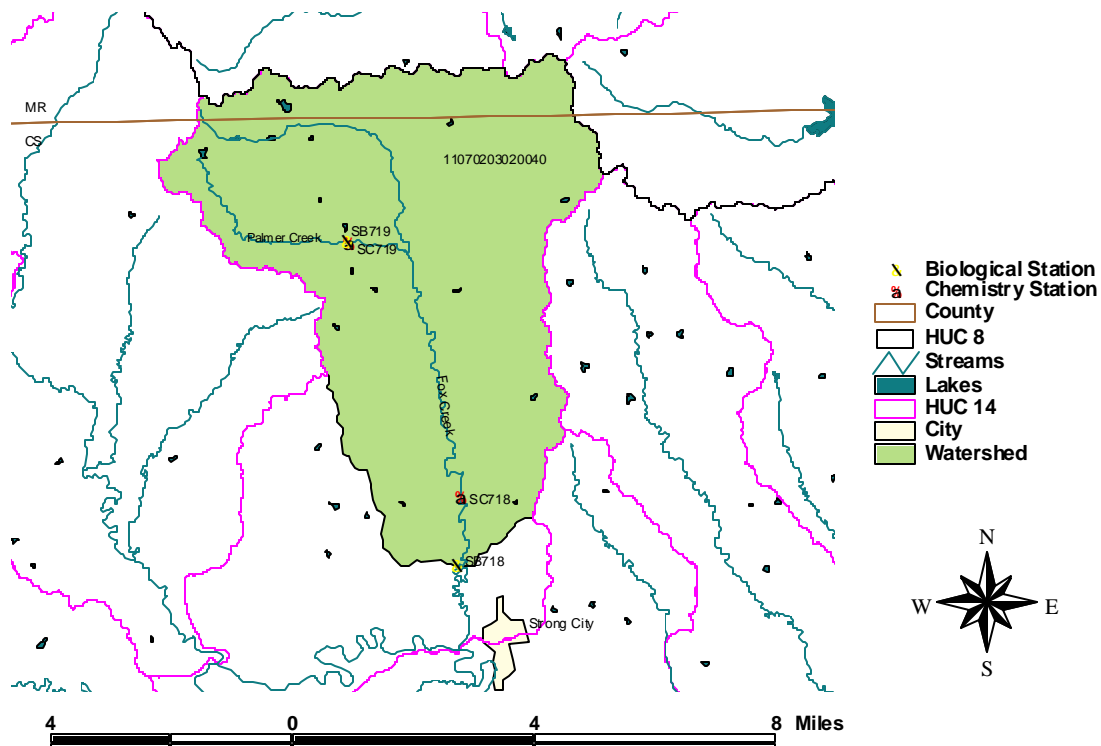


Figure 1

**Current Conditions:**

Three main parameters (MBI, KBI, and %EPT) were analyzed to address the biology impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index value is computed which characterizes the overall tolerance of the community. The higher the index values the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use. The Kansas Biotic Index (KBI) is similar to the MBI in that it indicates the impact of nutrient and oxygen demanding pollutants.

The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders: Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality.

The statistics from the two monitoring stations indicate that the biological communities are not significantly different. The MBI, KBI, and EPT indices show partial support of aquatic life. The percent mussel loss for Fox Creek (station 718) indicates non-support. Percent mussel loss was not determined at the Palmer Creek station (station 719). Because of the insufficient data, station 719 was not placed on the 2002 303(d) list yet was put in Category 2. Since the other indices indicate impairment, station 719 is included in this TMDL. The metrics for both sites are as follows:

Average of Metrics at Fox and Palmer Creek

<b>Monitoring Station</b>	<b>MBI</b>	<b>KBI</b>	<b>% EPT Count</b>	<b>% Mussel Loss</b>
<b>Fox Creek (Station 718)</b>	<b>4.58</b>	<b>2.70</b>	<b>47.25</b>	<b>57</b>
<b>Palmer Creek (Station 719)</b>	<b>4.64</b>	<b>2.76</b>	<b>40.50</b>	<b>N/A</b>

Two sources of pollution exist in the watershed: animal waste and fertilizer applications. On December 6, 2000, a general management plan/environmental impact statement was finalized for the Tallgrass Prairie National Preserve. (The majority of the watershed lies within the boundary of the preserve). This action plan details ways to reduce the pollution in the Fox Creek watershed. These actions should reduce the nutrient load to Fox and Palmer Creeks. The table below shows the changes in water quality since the best management practices went into effect.

### Changes in Water Quality Before and After December 6, 2000

Station	TKN (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>2</sub>	NO <sub>3</sub> (mg/L)	TP (mg/L)	OP	TSS (mg/L)	BOD (mg/L)	FCB (counts/ 100 mL)
Fox Creek (Station 718)									
Before	0.468	0.023	ND*	0.23	0.053	ND	28	2.05	2380
After BMPs	0.250	0.081^	ND	0.15	0.056	ND	30	1.37	2855
Palmer Creek (Station 719)									
Before	0.237	0.022	ND	0.07	0.146	ND	10	1.59	1784
After BMPs	0.238	0.079^	ND	0.12	0.031	ND	7	1.31	183

\* ND = Not Detected

^ The ammonia detection limit was changed from 0.020 mg/L to 0.100 mg/L.

No significant changes were detected with most parameters at both sites. Although the ammonia concentrations increased significantly, this is an artifact of the change in the detection limit from 0.020mg/L to 0.100 mg/L in 2002. The last date that ammonia was detected was March 14, 2001. Because aquatic insects and mussel are intolerant to ammonia, the ammonia levels need to remain below the detection limit. Load duration curves for total phosphorus and total nitrogen are located in Appendix B.

The last biological samples were taken on May 23, 2001. Best Management Practices may not have been in effect long enough to see an improvement in the aquatic community (Appendix A). Continued monitoring will be required to assess the long term impacts.

### Desired Endpoints of Water Quality at Sites 718 and 719 over 2007 - 2011:

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water seasons (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be no more than one sampling with a MBI values greater than 4.5 over 2007-2011.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach. While there is linkage between MBI values and nutrient loading, there have been no violations of chronic water quality criteria. Therefore, this TMDL will be phased, concentrating on lowering total phosphorus and total nitrogen levels. Part of this endpoint may already be occurring because of Best Management Practices implemented in the Tallgrass Prairie National Preserve.

### Current Condition and Reductions

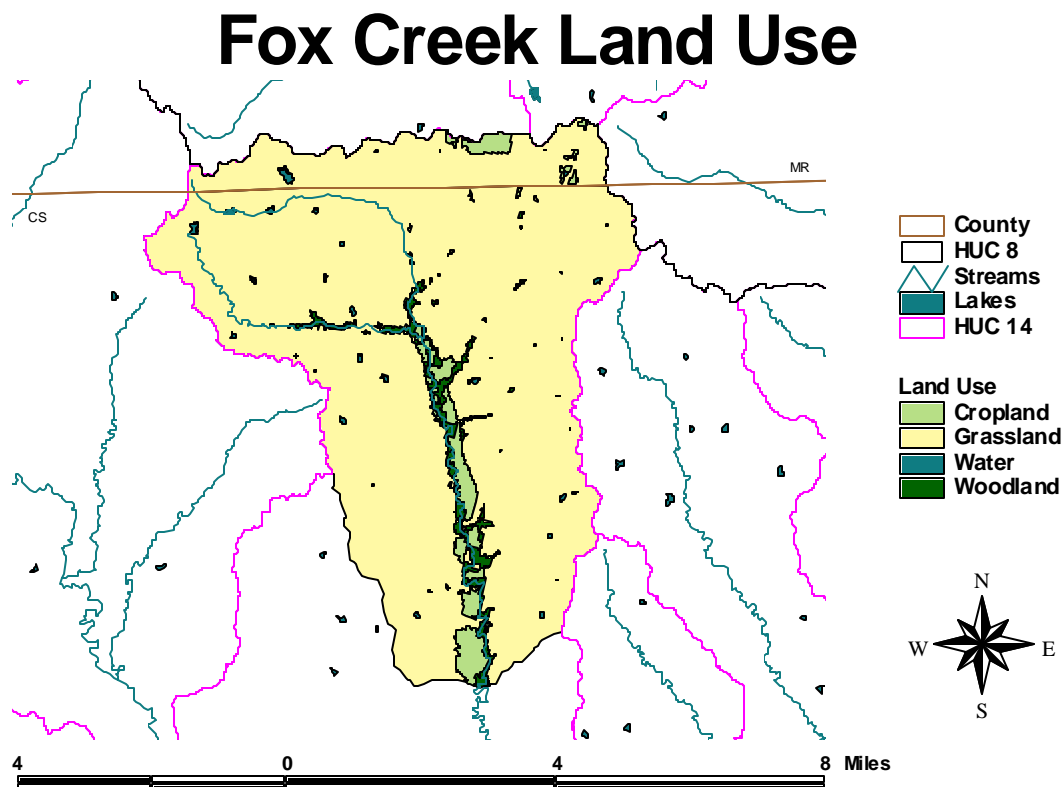
Parameter	Current Condition	TMDL	Percent Reduction
<b>Fox Creek (Station 718)</b>			
Total Phosphorus (mg/L)	0.053	< 0.055	0 %
Total Nitrogen (mg/L)	0.673	< 0.502	25 %
Macroinvertebrate Biotic Index	4.58	< 4.5	2 %
Kansas Biotic Index	2.70	< 2.6	4 %
EPT Count (%)	47.25	> 48	2 % Increase
Mussel Loss (%)	57	< 10	82 % Increase
<b>Palmer Creek (Station 719)</b>			
Total Phosphorus (mg/L)	0.146	< 0.085	42 %
Total Nitrogen (mg/L)	0.344	< 0.394	0 %
Macroinvertebrate Biotic Index	4.64	< 4.5	3 %
Kansas Biotic Index	2.76	< 2.6	6 %
EPT Count (%)	40.50	> 48	19 % Increase

### 3. SOURCE INVENTORY AND ASSESSMENT

Animal waste coming from grazing areas is the primary contributing factor. Ninety-three percent of land around the lake is grassland. The winter grazing density is high, and the summer grazing density is medium. A secondary source of nutrients within the Fox Creek Watershed is probably runoff from agricultural lands where phosphorus and nitrogen have been applied. Land use coverage analysis indicates that 4% of the watershed is cropland (Figure 2). The majority of the cropland is adjacent to the Southern half of Fox Creek. There is no cropland in the Palmer Creek watershed. The population density in the watershed is low, 4.8 people per square mile. The nearest town is Strong City, which is anticipating no change in population until the year 2020.

**Background Levels:** Three percent of the Fox Creek watershed is woodland. Leaf litter falls into the streams and decomposes increasing the oxygen demand. The atmospheric deposition and geological formations (i.e., soil and bedrock) may contribute to phosphorus and nitrogen loads.

Figure 2



#### 4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

There is a direct relation between levels of nutrient loading and biological integrity. Decreased loads should result in improved aquatic communities, and biological metrics indicative of improved water quality. The goal of this TMDL is to maintain the MBI scores below 4.5 and keep total phosphorus and total nitrogen levels below levels seen prior to December 2000. The decrease of nutrient levels will apply over the range of flows encountered on Fox and Palmer Creeks, indicated by the TMDL curves in Appendix B.

**Point Sources:** A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers.

**Nonpoint Sources:** The composition of the watershed indicates that animal waste and fertilizer applications contribute to the nutrient load downstream. These sources tend to become dominant under all flow conditions. Therefore, the entire area under the load duration curves constitutes the Load Allocation for this TMDL.

**Defined Margin of Safety:** Additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 48% of the sample population, including ammonia intolerant species, when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa. This measure may also correlate with the availability of adequate habitat in the stream to support such a community.

**State Water Plan Implementation Priority:** To further support the implementation of the best management practices, this TMDL will be a Medium Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Lower Cottonwood River Subbasin (HUC 8: 11070203) with a priority ranking of 43 (Medium Priority for restoration work).

**Priority HUC 11s and Stream Segments:** The entire watershed is within HUC 11s (020).

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

- a. Follow the action plan outlined in the Record of Decision, Final General Management Plan/Final Environmental Impact Statement.
- b. Mussel loss data should be collected at Palmer Creek (station 719).
- c. Assess land use outside of the Tallgrass Prairie National Preserve.
- d. Improve aquatic habitat quality.
- e. Reintroduce Unionid Mussel Species.

### **Implementation Programs Guidance**

#### **Biological Monitoring - KDHE**

- a. Sample mussel community at Palmer Creek.

#### **National Park Service - U. S. Department of the Interior**

- a. Coordinate with State agencies to implement the Best Management Practices.

#### **Nonpoint Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects, such as the Twin Lakes project in

Morris County, for reduction of sediment runoff from agricultural activities as well as nutrient management.

- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.
- d. Update and implement nutrient and sediment abatement strategies.
- e. Develop a Watershed Restoration and Protection Strategy for HUC 11070203.

**Water Resource Cost Share Nonpoint Source Pollution Control Program - SCC**

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.
- b. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

**Riparian Protection Program - SCC**

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects.
- c. Promote wetland construction to assimilate nutrient loadings.

**Buffer Initiative Program - SCC**

- a. Install grass buffer strips near streams, particularly by the Southern half of Fox Creek.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

**Extension Outreach and Technical Assistance - Kansas State University**

- a. Educate agricultural producers on sediment, nutrient, and pasture management.
- b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- c. Provide technical assistance on livestock waste management systems and nutrient management plans.
- d. Provide technical assistance on buffer strip design and minimizing cropland runoff.
- e. Encourage annual soil testing to determine capacity of field to hold nutrients.

**Species Recovery - KDWP**

- a. Evaluate habitat quality.
- b. Improve habitat and reintroduce Unionid Mussel species as necessary.

**Time Frame for Implementation:** Evaluation of local water quality improvements in the watershed should occur prior to 2007.



**Targeted Participants:** Primary participants for implementation will be the National Park Service and agricultural producers within the watershed.

**Milestone for 2007:** The year 2007 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, adequate Best Management Practices should be implemented which allows for protection of the watershed.

**Delivery Agents:** The primary delivery agents for program participation will be the National Park Service.

**Reasonable Assurances:**

**Authorities:** The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.
2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
3. K.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.
4. K.S.A. 82a-901, *et seq.* empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
6. The *Kansas Water Plan* and the Neosho Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

**Funding:** The State Water Plan Fund annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the Kansas Water Plan. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water

quality protection. This watershed and its TMDL are a **Medium Priority** consideration. Priority should be given to activities which reduce loadings of sediment and organic material to the stream after 2007.

**Effectiveness:** Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming and installation of buffer strips within the watersheds cited in the Record of Decision.

## 6. MONITORING

At first, KDHE will continue to collect seasonal biological samples from Fox and Palmer Creeks for at least three years over 2002 - 2007 and an additional three years over 2007-2011 to evaluate continued ammonia levels below the detection limit of 0.10 mg/L and achievement of the desired biological endpoint. Mussel loss data must be collected at station 719 to verify if a true impairment exists.

## 7. FEEDBACK

**Public Meetings:** Public meetings to discuss TMDLs in the Neosho Basin were held January 9, 2002 in Burlington and March 4, 2002 in Council Grove. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Neosho Basin.

**Public Hearing:** Public Hearings on the TMDLs of the Neosho Basin were held in Burlington and Parsons on June 3, 2002.

**Basin Advisory Committee:** The Neosho Basin Advisory Committee met to discuss the TMDLs in the basin on October 2, 2001, January 9, March 4, and June 3, 2002.

**Discussion with Interest Groups:** Meetings to discuss TMDLs with interest groups include:  
Kansas Farm Bureau: February 26 in Parsons and February 27 in Council Grove

**Milestone Evaluation:** In 2007, evaluation will be made as to the amount of water quality improvement activity which has occurred within the watershed and current condition of the Neosho River. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

**Consideration for 303(d) Delisting:** The stream will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2007-2011. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable

water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

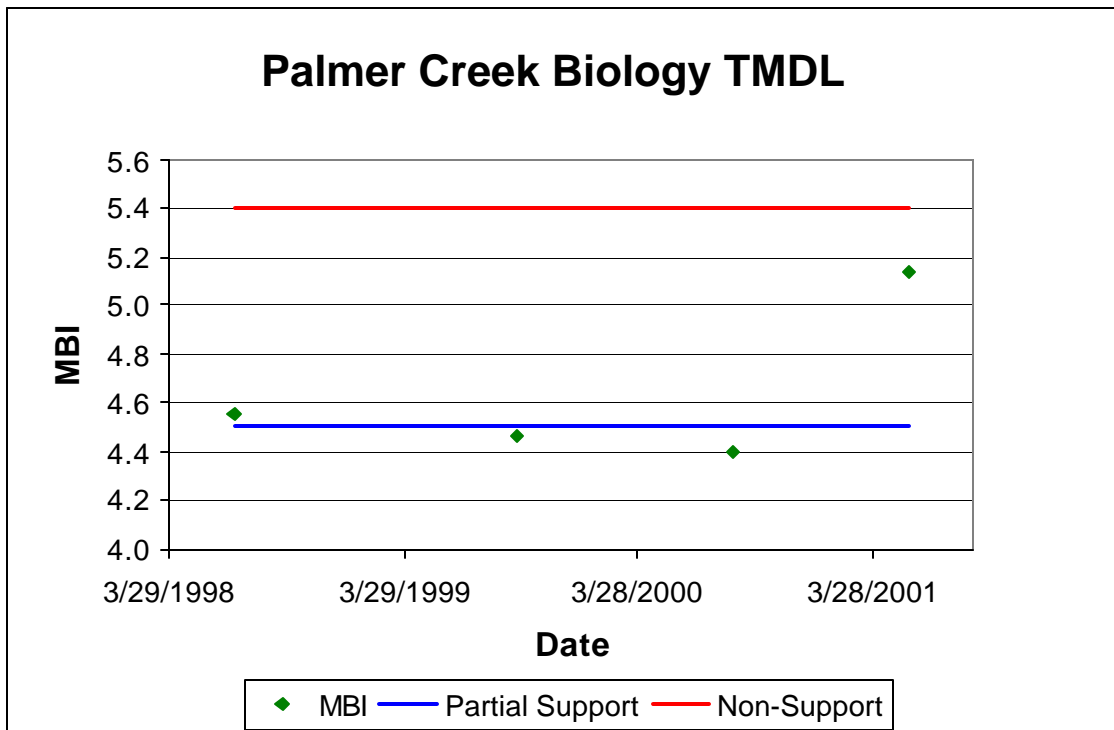
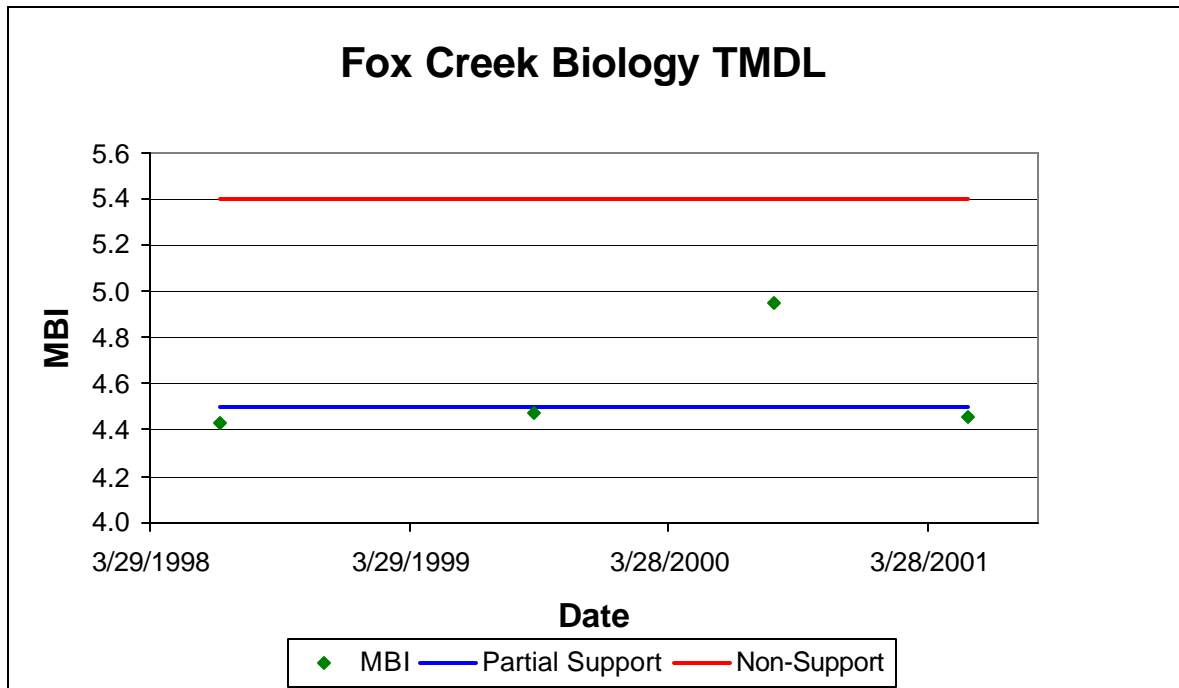
**Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process:** Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2003 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2003-2007.

## **Bibliography**

Augspurger T, Keller AE, Black MC, Cope WG, and Dwyer FJ. 2003. Water Quality Guidance for Protection of Freshwater Mussels (Unionidae) from Ammonia Exposure. *Environmental Toxicology and Chemistry*, Vol. 22, No. 11, pp. 2569-2575.

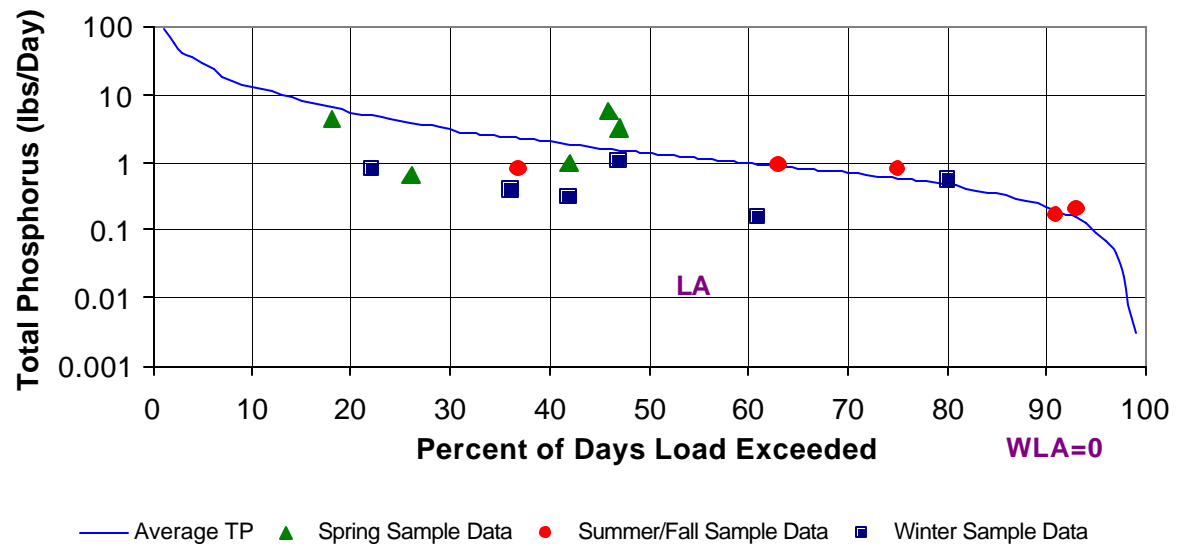
United States Department of the Interior, National Park Service. 2000. Record of Decision: Final General Management Plan/ Final Environmental Impact Statement, Tallgrass Prairie National Preserve, Kansas.

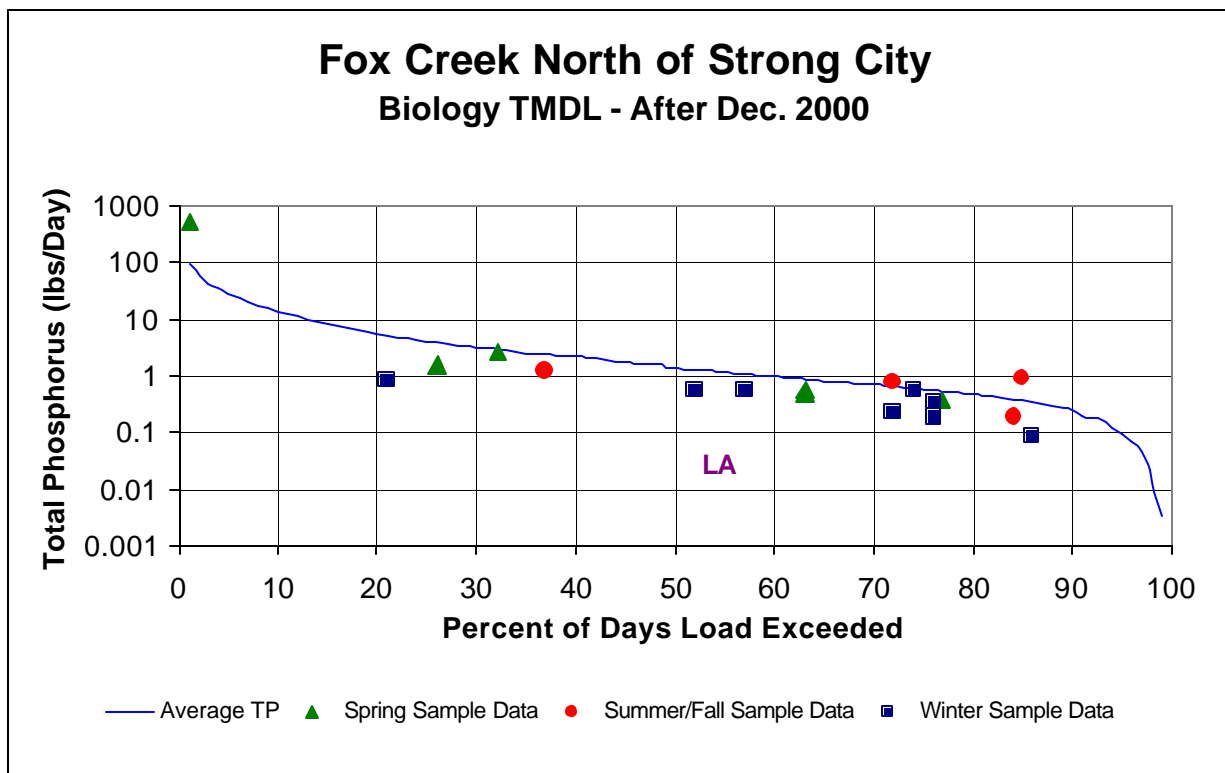
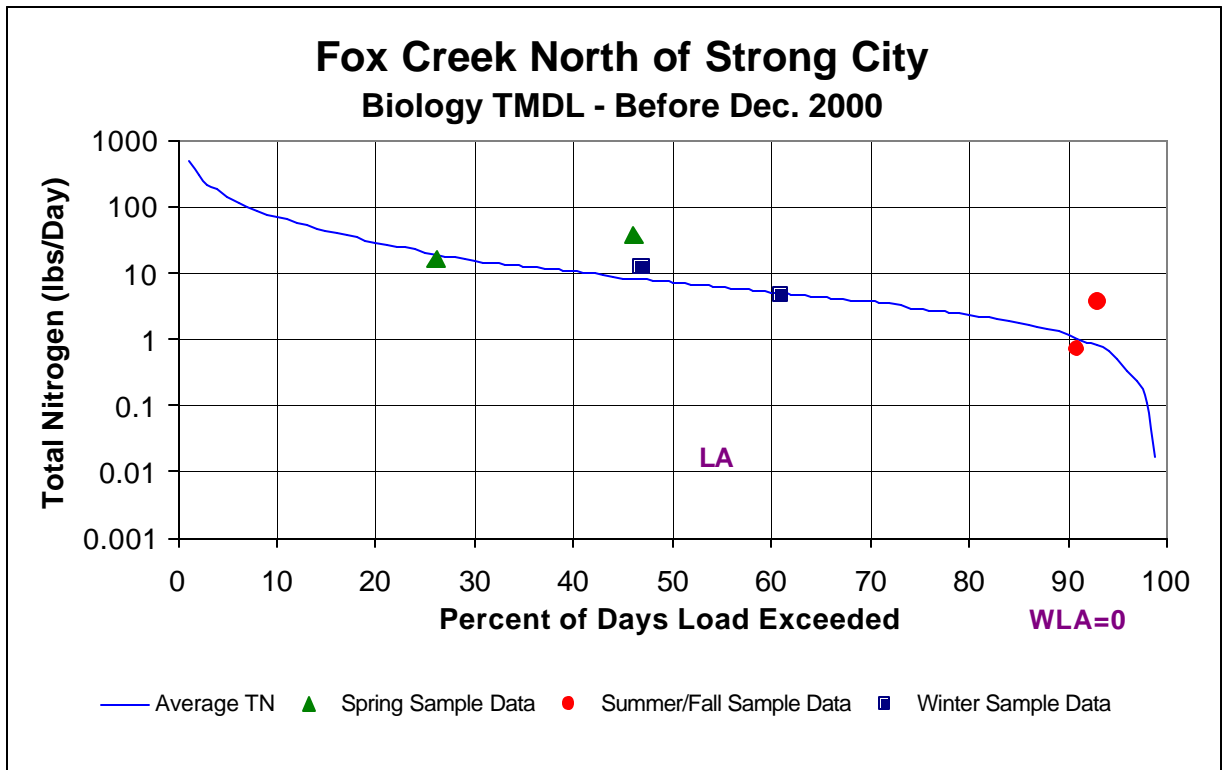
## APPENDIX A

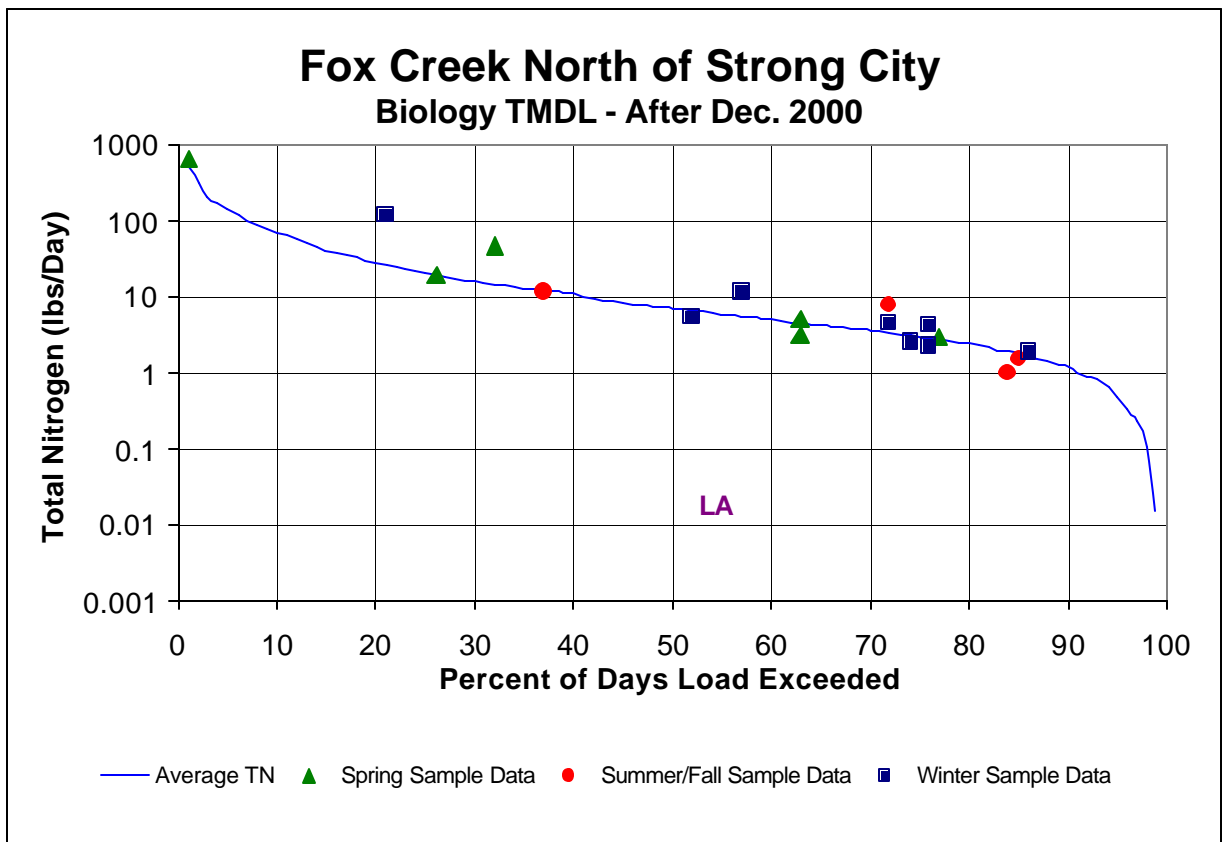
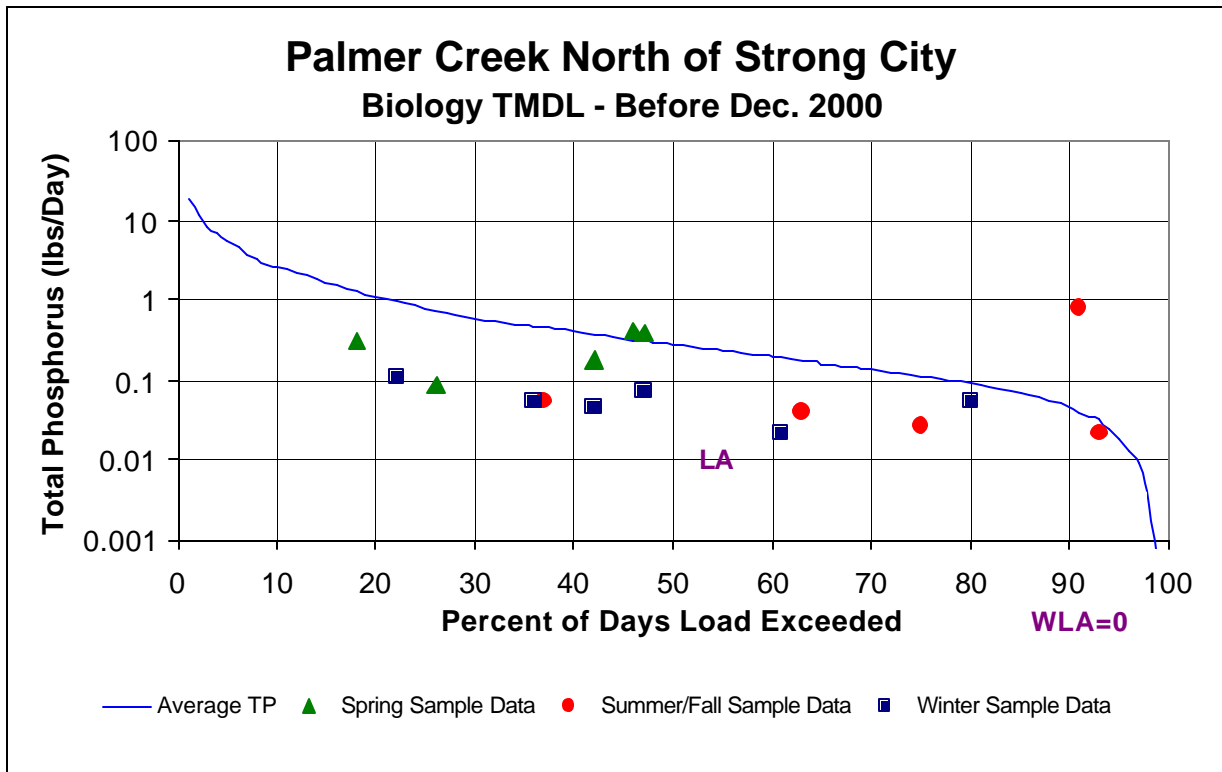


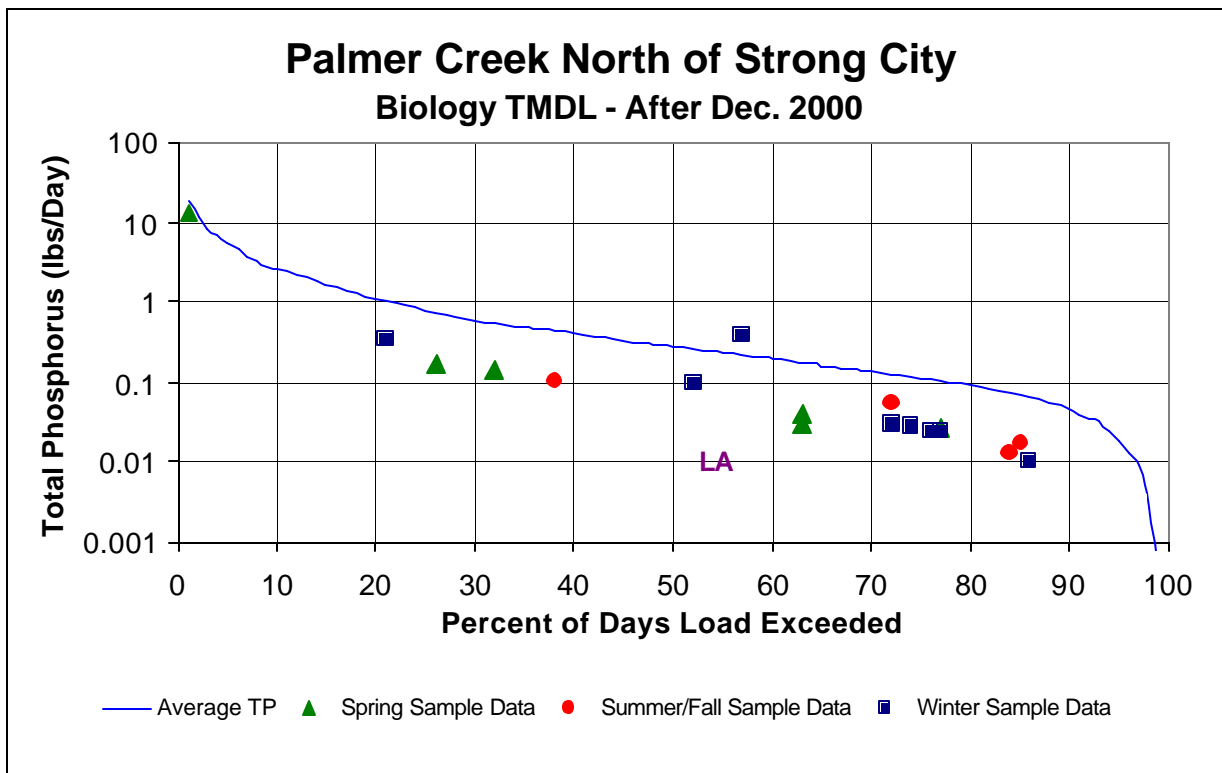
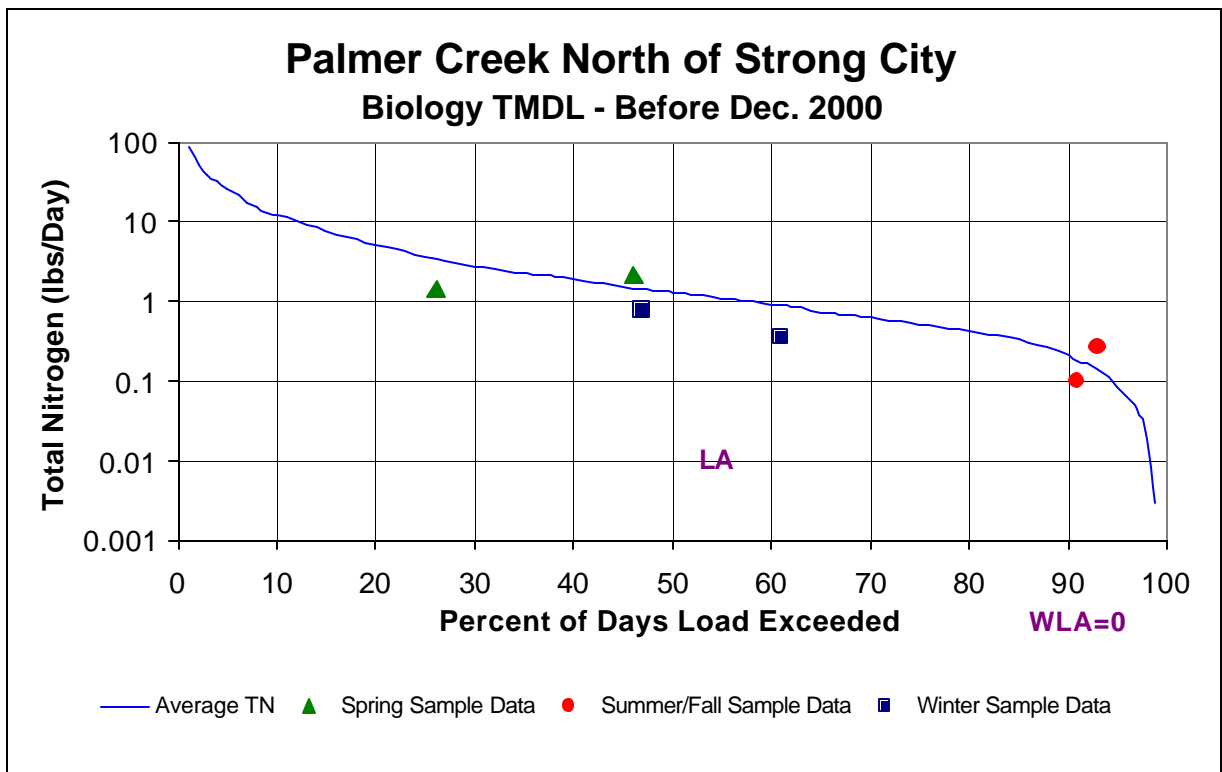
## APPENDIX B

### Fox Creek North of Strong City Biology TMDL - Before Dec. 2000



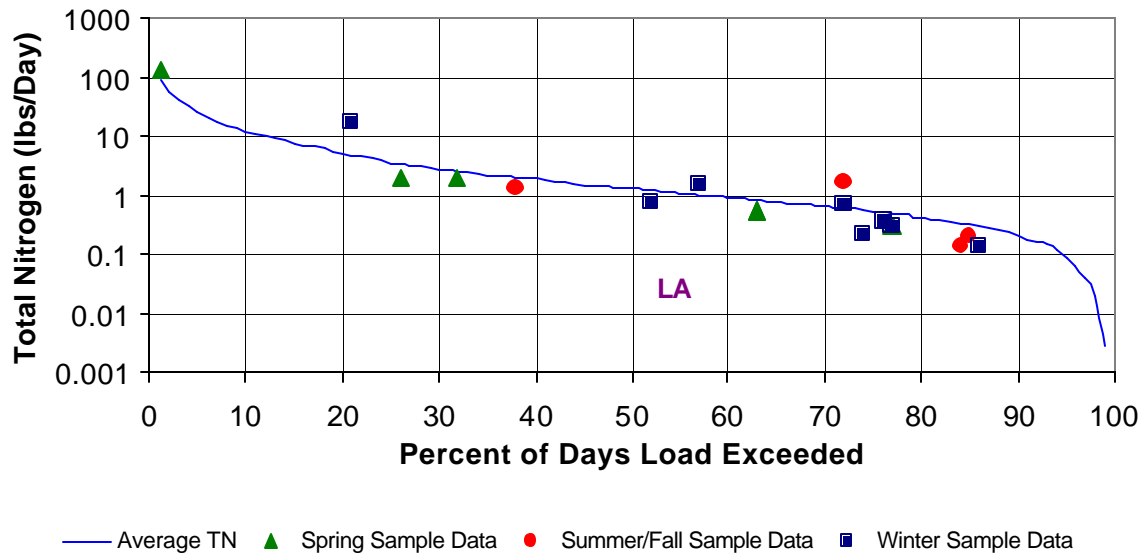








## Palmer Creek North of Strong City Biology TMDL - After Dec. 2000



7/8/04